Impacts and Costs of Chlorides in Winter Maintenance Operations

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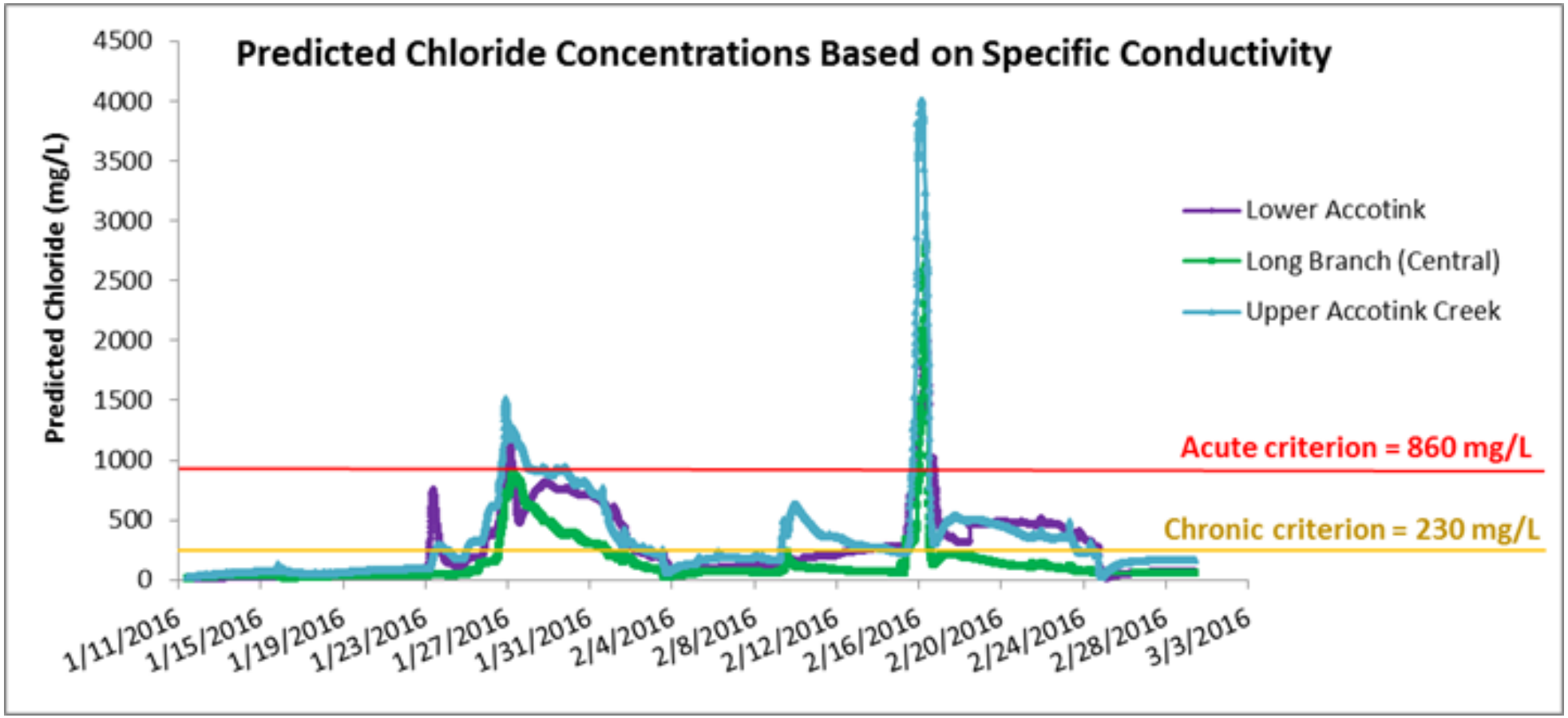
Interstate Commission
on the
Potomac River Basin

Virginia street after winter storm.
Photo by Jim Palmer.

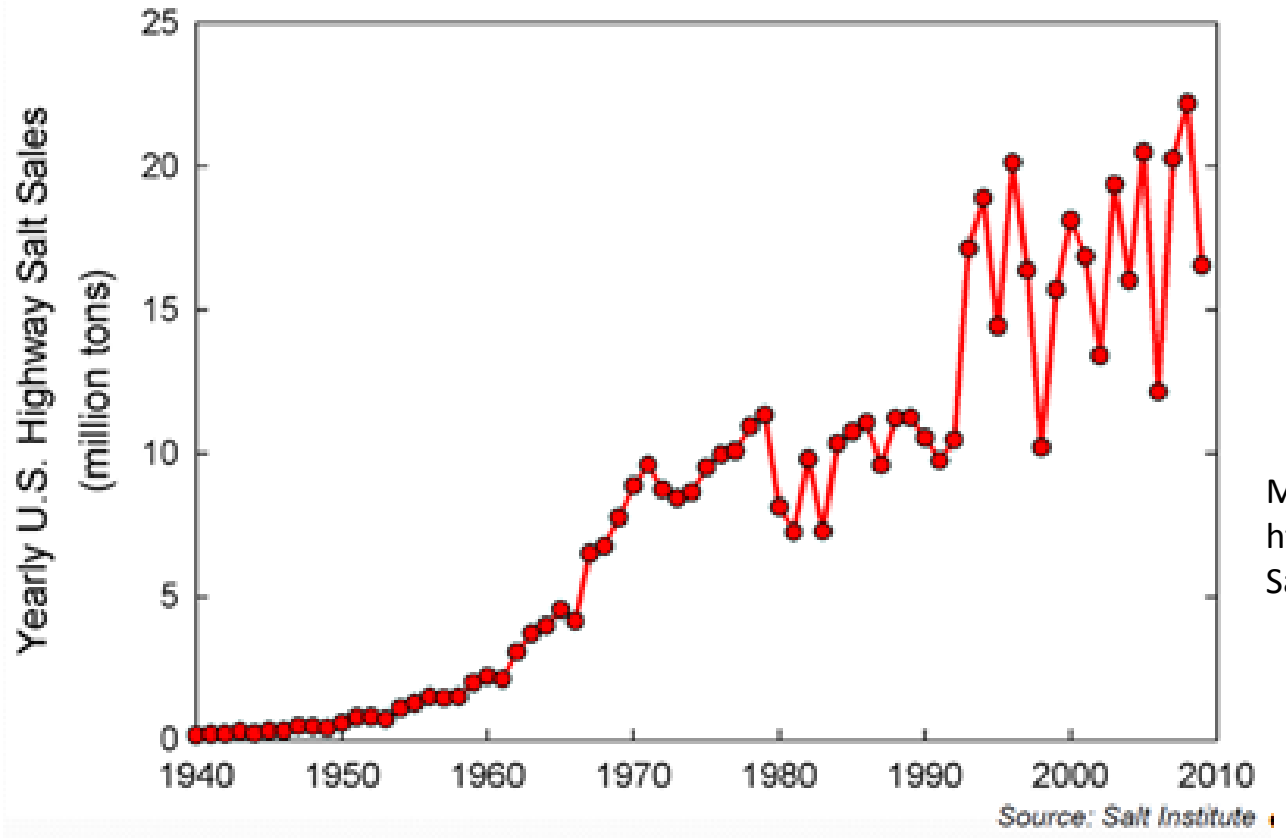
Overview

- Introduction
- Salt Transport Pathways
- Impacts of Deicing Salts
  - Environmental
  - Infrastructure and Property
  - Drinking Water Systems
- Economic Costs and Benefits of Improved Salt Management
  - Economic Costs of Salt Application
  - Economic Benefits of BMPs

Introduction



Introduction



Minnesota Pollution Control Agency: https://stormwater.pca.state.mn.us/index.php?title=File:Road_Salt_Sales_Trend_in_the_United_States.PNG#metadata

Salt Transport Pathways

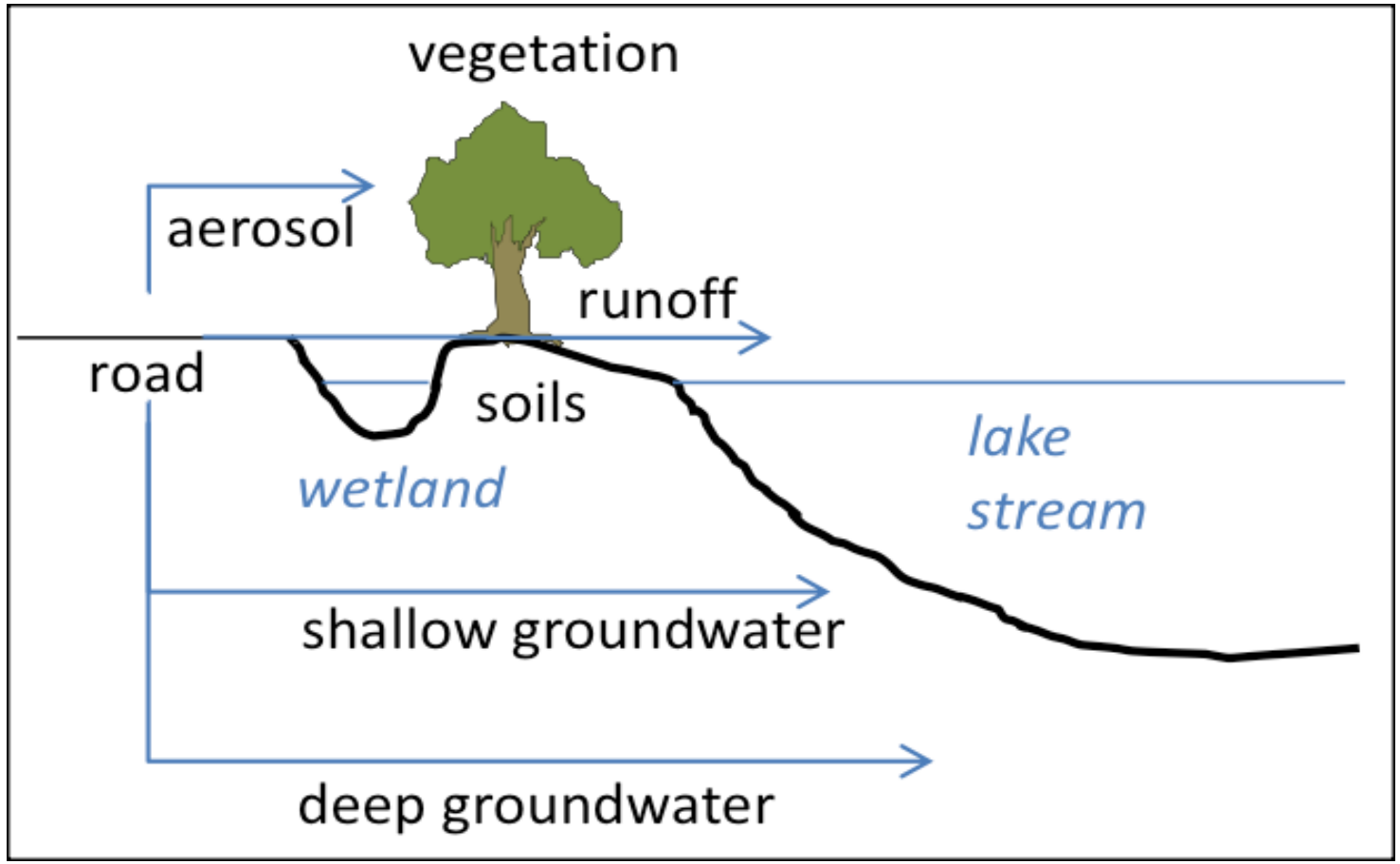


Figure reprinted from Connecticut Academy of Science and Engineering (CASE). 2015. *Winter Highway Maintenance Operations: Connecticut.* Rocky Hill, CT: Connecticut Transportation Institute, UConn.

Impacts of Deicing Salts: Environmental

- Surface Water and Groundwater – salts increase with greater use in winter maintenance linked to urbanization
- Soil – salts can react with soils, seeping into groundwater and subsequently traveling to surface waters
- Biological – increased chlorides can be harmful to aquatic and terrestrial plants and animals

Damaged roadway vegetation. Photo by MPCA (2016).

Impacts of Deicing Salts: Infrastructure and Property

- Bridges, Roads, and Pipes
  - Corrosion of reinforcing steel
  - Corrosion of pipes for drinking water and stormwater conveyance systems
  - Reactions between salt and cement
  - Increases in the # of freezing and thawing cycles
- Vehicles
  - Corrosion to metal, brakes, etc.

Bridge corrosion. Photo by Jim Palmer.

Impacts of Deicing Salts: Drinking Water Systems

- Public health
- Increased treatment costs
  - Chlorine demand
  - Corrosion inhibitors
- Taste and odor complaints
- Mobilization of nutrients causing harmful algal blooms

USEPA photo by Eric Vance.

Economic Costs of Salt Application

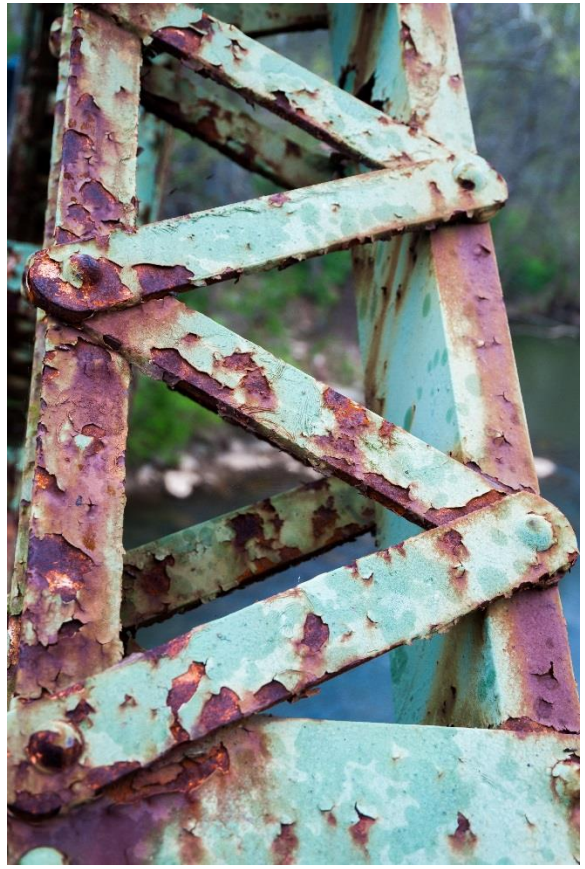
- Direct Costs
  - Labor
  - Materials
  - Equipment
  - Training
- Indirect Costs
  - Infrastructure and Property
  - Environmental
  - Public Health
  - Drinking Water Suppliers

Example indirect costs ($USD/ton) of salt use for winter road maintenance (adapted from Fortin Consulting 2014).

Reference	Vehicle Corrosion	Infrastructure		Environmental	
		Extra Road Maintenance	Infrastructure Damage	Tree Damage	Ecosystem Damage
Low Estimate	$30	$600		$75	$172
High Estimate	$113	$615	$1,460	$110	$227

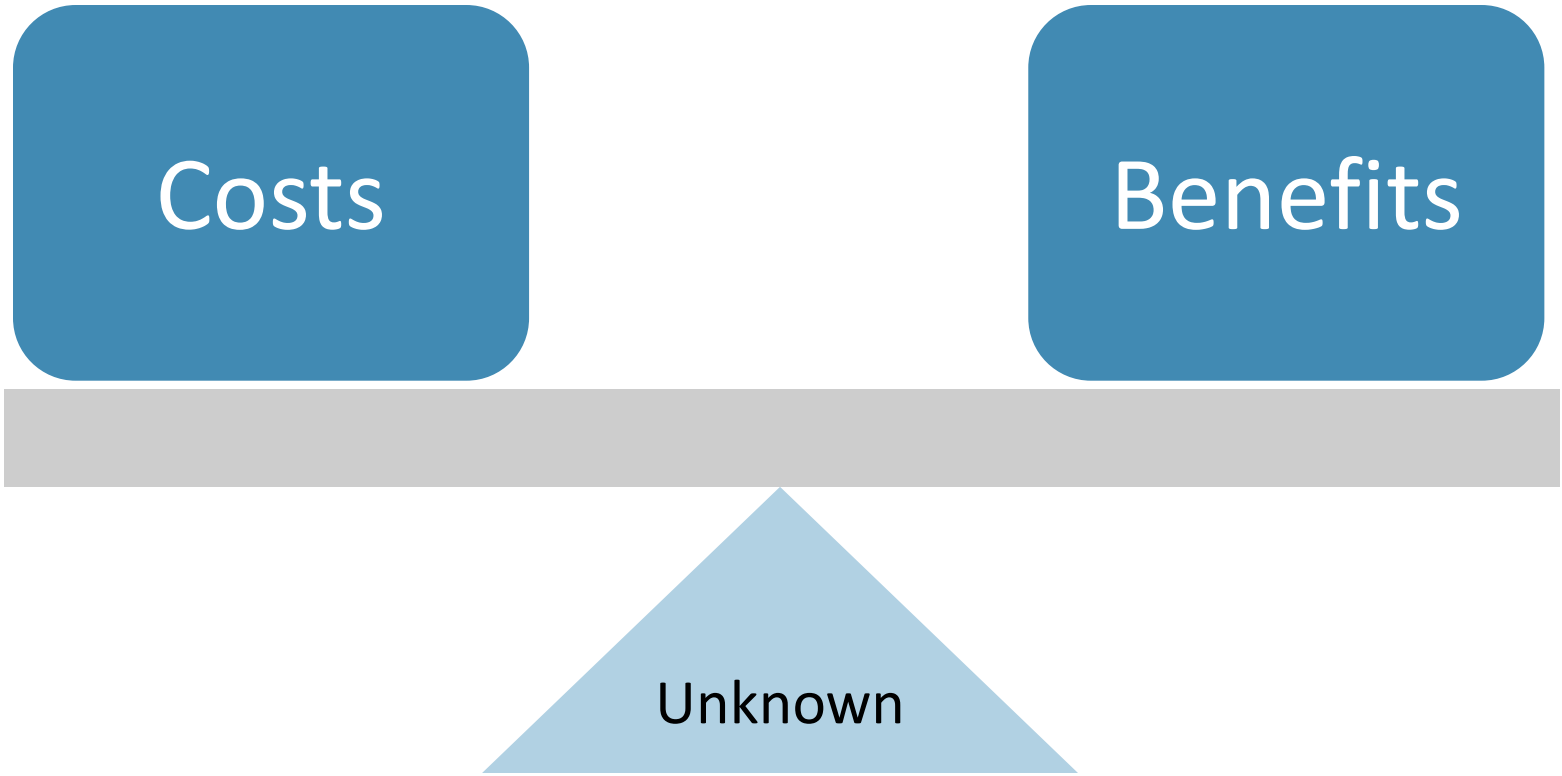
Economic Benefits of Improved Winter Salt Use

- Reduced direct costs to winter service providers
- Reduced indirect costs to address corrosion, other damage to infrastructure and property, water supply treatment
- Fewer environmental impacts
- Reduced public health risks



Bridge corrosion. Photo by Jim Palmer.

Balancing Costs and Benefits



Conclusions

- Deicing materials are essential to public safety during winter storm events.
- Once applied, these materials remain in the environment and have numerous ecological and infrastructure related impacts.
- Using appropriate salt products and application methods can reduce direct and indirect costs.
- The reviewed literature demonstrates the ability to successfully reduce the costs and negative impacts of salt products applied to manage snow and ice, while maintaining high standards of public safety.

Plowed street. Photo by Jim Palmer.

The full literature review is available online at….

http://www.deq.virginia.gov/SaMS.aspx

or

Search for "DEQ Salt Management Strategy"

For additional information

- Accotink Creek chloride TMDL. http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/drftmdls/Vol_III_Draft_CL_TMDL_12-20-17.pdf

- Fay, L., D. Veneziano, A. Muthumani, X. Shi, A. Kroon, C. Falero, M. Janson, and S. Petersen. 2015. Benefit-Cost of Various Winter Maintenance Strategies. Minnesota Department of Transportation No. CR 13-03. http://clearroads.org/wp-content/uploads/dlm_uploads/FR_CR.13-03_Final.pdf

- Minnesota Pollution Control Agency (MPCA). 2016. Twin Cities Metropolitan Area Chloride Management Plan. https://www.pca.state.mn.us/sites/default/files/wq-iw11-06ff.pdf

Questions?